

REMARKS

Claims 1-18, 22-24, 27-46, 51 and 53-87 are pending in this application. Claims 1-15, 31-39 and 58-87 are currently withdrawn. By this Amendment, claims 16, 22-24, 41 and 51 are amended, and claims 20, 21, 25, 26, 47-50 and 52 are canceled. No new matter is added. Support for the claim amendments may be found, for example, in paragraph [0128] of the original specification.

Applicants appreciate the courtesies shown to Applicants' representative by Examiner Olsen in the February 1, 2007 interview. Applicants' separate record of the substance of the interview is incorporated into the following remarks.

I. Rejections Under 35 U.S.C. §103(a)

A. Rejection over Niu in view of Ito

Claims 16-18, 20-30 and 40-57 were rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over U.S. Patent Publication 2002/0008956 (hereinafter Niu) in view of WO 2002/45113 (hereinafter Ito).

Claim 16 recites a method of manufacturing a carbon nanotube structure, comprising the steps of supplying a base body with a liquid solution containing carbon nanotubes that have functional groups, cross-linking the plural carbon nanotubes to one another by causing the functional groups to form chemical bonds among themselves to thereby form a mesh structure of the carbon nanotube structure, and patterning the carbon nanotube structure layer into a desired shape (a patterning step) wherein the patterning step is a resist layer forming step of forming a resin resist layer on the region of the carbon nanotube structure layer on the base body surface that is to be patterned into a desired shape, and a removal step of removing the exposed portions of the carbon nanotube structure layer that are not covered with the resist layer by dry etching.

Niu nowhere discloses the patterning process of claim 16, wherein the patterning step includes a resist layer forming step of forming a resin resist layer on the region of the carbon nanotube structure layer on the base body surface that is to be patterned into a desired shape, and a removal step of removing the exposed portions of the carbon nanotube structure layer that are not covered with the resist layer by dry etching. That is, Niu does not teach or suggest the patterning of claim 16. As such, Niu does not teach or suggest the method of claim 16 or claims dependent therefrom.

Claim 41 recites a method of manufacturing a carbon nanotube structure, comprising the steps of applying a liquid solution containing carbon nanotubes that have functional groups to a surface of a temporary substrate, cross-linking the plural carbon nanotubes to one another by causing the functional groups to form chemical bonds among themselves to thereby form a mesh structure of a carbon nanotube structure layer, and patterning the carbon nanotube structure layer into a desired shape, wherein the patterning is a resist layer forming step of forming a resin resist layer on a region of the carbon nanotube structure layer on the temporary substrate surface that is to be patterned into a desired shape and a removal step for bringing an etchant into contact with a side of the temporary substrate where the carbon nanotube structure layer and the resist layer are layered, thereby removing the carbon nanotube structure layer from the exposed regions that are not covered with the resist layer, and transferring the patterned carbon nanotube structure layer to a base body.

Niu also does not teach the method of making the carbon nanotube of claim 41. Nowhere does Niu disclose that the patterning is a resist layer forming step of forming a resin resist layer on a region of the carbon nanotube structure layer on the temporary substrate surface that is to be patterned into a desired shape and a removal step for bringing an etchant into contact with a side of the temporary substrate where the carbon nanotube structure layer and the resist layer are layered, thereby removing the carbon nanotube structure layer from the

exposed regions that are not covered with the resist layer, and transferring the patterned carbon nanotube structure layer to a base body. That is, Nui does not teach or suggest patterning of claim 41. As such, Niu does not teach or suggest the method of claim 41 or claims dependent therefrom.

The Patent Office acknowledges that Niu does not teach or suggest dry etching to pattern the crosslinked carbon nanotubes. The Patent Office relied on Ito as allegedly teaching dry etching to pattern. Ito does not overcome the deficiencies of Niu in that at least Ito does not teach or suggest patterning of the present claims.

Ito discloses patterning carbon nanotubes through a first dry etching method by removing part of the carbon nanotubes adhered to a substrate or a substrate having a thin film coated on at least part of a surface thereof. A mask for patterning the carbon nanotubes is used. The mask is a film, for example a film that is made of metal. See paragraphs [38], [105], [121] and [122] of Ito.

The present application discloses a resist formed by a resin layer. The resist layer is removed by dry etching, such as through irradiation of oxygen molecule radicals, which are generated by irradiating oxygen molecules with an ultraviolet ray. The present claims employ a resin by forming a resin layer as the resist layer. The carbon nanotube structure layer of the present application has a mesh-like network of carbon nanotubes and is a porous structure.

On the other hand, Ito describes use of a metal film or like material resist. Such a resist does not infiltrate deep into the holes of the mesh, as a result of which the carbon nanotubes will not be sealed satisfactorily, and insufficient sealing results in exposure to plasma or the like. As a result, plasma or the like enters from the holes and corrodes the carbon nanotube layer under the resist layer, reducing the contour of the carbon nanotube structure layer and leaving only a small portion of the carbon nanotube structure layer. See paragraph [0128] of the present specification.

In contrast, the resin resist of the present application enters the spaces inside the holes and reduces the number of carbon nanotubes that are exposed to plasma or the like. As a result, high density patterning of the carbon nanotube structure layer is made possible. See paragraph [0129] of the present specification.

Further, the Patent Office acknowledges that Ito does not teach using UV irradiation of oxygen to generate oxygen radicals. The Patent Office indicates that UV irradiation and the means allegedly taught by Ito are art recognized to be functionally equivalent methods of generating oxygen radicals. Applicants remind the Examiner that components that are allegedly functionally equivalent are not necessarily obvious in view of one another. See MPEP §2144.06. In this case, for example, the use of burning in an oxygen ambient as in Ito does not fairly suggest the use of UV irradiation as in claim 23.

Nowhere does Ito teach or suggest the subject matter of the present claims. Even if Ito were to have been combined with Niu, the presently claimed subject matter still would not have been achieved for the reasons detailed above.

For the foregoing reasons, Applicants respectfully submit that Niu and Ito, alone or in combination, would not have led one of ordinary skill in the art to claims 16-18, 23, 24, 27-30, 40-46, 51 and 53-57. Reconsideration and withdrawal of this rejection are respectfully requested.

B. Rejection over Horiuchi in view of Ito

Claims 16-18, 20-29, 40-46 and 53-56 were rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over U.S. Patent Publication 2002/0122765 (hereinafter Horiuchi) in view of Ito.

Horiuchi discloses a method for manufacturing carbon nanotube structures. However, Horiuchi, like Niu discussed above, does not disclose the patterning process of claim 16, wherein the patterning step includes patterning step is a resist layer forming step of forming a

resin resist layer on the region of the carbon nanotube structure layer on the base body surface that is to be patterned into a desired shape, thus removing the exposed portions of the carbon nanotube structure layer that are not covered with the resist layer by dry etching and patterning the carbon nanotube structure layer into the desired shape. As such, Horiuchi does not teach or suggest the method of claim 16 or claims dependent therefrom.

Horiuchi does not teach the method of making the carbon nanotube of claim 41. Nowhere does Horiuchi disclose a resist layer forming step of forming a resin resist layer on a region of the carbon nanotube structure layer on the temporary substrate surface that is to be patterned into a desired shape, and a removal step for bringing an etchant into contact with a side of the temporary substrate where the carbon nanotube structure layer and the resist layer are layered, thereby removing the carbon nanotube structure layer from the exposed regions that are not covered with the resist layer, and transferring the patterned carbon nanotube structure layer to a base body. That is, Horiuchi does not teach or suggest the patterning step of claim 41. As such, Horiuchi does not teach or suggest the method of claim 41 or claims dependent therefrom.

The Patent Office turned to Ito as allegedly teaching dry etching to pattern. Ito does not overcome the deficiencies of Horiuchi in that at least Ito does not teach or suggest patterning according to the present claims.

Ito discloses patterning carbon nanotubes through a first dry etching method by removing part of the carbon nanotubes adhered to a substrate or a substrate having a thin film coated on at least part of a surface thereof. A mask for patterning the carbon nanotubes is used. The mask is a film, for example a film that is made of metal. See paragraphs [38], [105], [121] and [122] of Ito.

The present application discloses a resist formed by a resin layer. The resist layer is removed by dry etching, such as through irradiation of oxygen molecule radicals, which are

generated by irradiating oxygen molecules with an ultraviolet ray. The present claims employ a resin by forming a resin layer as the resist layer. The carbon nanotube structure layer of the present application has a mesh-like network of carbon nanotubes and is a porous structure.

On the other hand, Ito describes use of a metal film or like material resist. Such a resist does not infiltrate deep into the holes of the mesh, as a result of which the carbon nanotubes will not be sealed satisfactorily, and insufficient sealing results in exposure to plasma or the like. As a result, plasma or the like enters from the holes and corrodes the carbon nanotube layer under the resist layer, reducing the contour of the carbon nanotube structure layer and leaving only a small portion of the carbon nanotube structure layer. See paragraph [0128] of the present specification.

In contrast, the resin resist of the present application enters the spaces inside the holes and reduces the number of carbon nanotubes that are exposed to plasma or the like. As a result, high density patterning of the carbon nanotube structure layer is made possible. See paragraph [0129] of the present specification.

Further, the Patent Office acknowledges that Ito does not teach using UV irradiation of oxygen to generate oxygen radicals. The Patent Office indicates that UV irradiation and the means allegedly taught by Ito are art recognized to be functionally equivalent methods of generating oxygen radicals. Applicants remind the Examiner that components that are allegedly functionally equivalent are not necessarily obvious in view of one another. See MPEP §2144.06. In this case, for example, the use of burning in an oxygen ambient as in Ito does not fairly suggest the use of UV irradiation as in claim 23.

Nowhere does Ito teach or suggest the subject matter of the present claims. Even if Ito were to have been combined with Horiuchi, the presently claimed subject matter still would not have been achieved for the reasons detailed above.

For the foregoing reasons, Applicants submit that Horiuchi and Ito, alone or in combination, fail to teach, suggest or render obvious the subject matter of the claims of the present application. Reconsideration and withdrawal of the rejection are respectfully requested.

III. Rejoinder

Applicants submit that upon allowance of the elected claims, claims 1-15, 31-39 and 58-87 should be rejoined with the application and similarly allowed.

IV. Conclusion

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of claims 1-18, 22-24, 27-46, 51 and 53-87 are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,



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Date: February 6, 2007

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